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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/518,026	12/15/2004	Masayuki Kinouchi	8007-1078	4925
466	7590	10/24/2008	EXAMINER	
YOUNG & THOMPSON 209 Madison Street Suite 500 ALEXANDRIA, VA 22314				BEST, ZACHARY P
1795		ART UNIT		PAPER NUMBER
10/24/2008		MAIL DATE		DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/518,026	KINOUCHI ET AL.	
	Examiner	Art Unit	
	Zachary Best	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 07 August 2008.
 2a) This action is **FINAL**. 2b) This action is non-final.
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-6,9,10 and 12-25 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
 5) Claim(s) _____ is/are allowed.
 6) Claim(s) 1-6,9,10 and 12-25 is/are rejected.
 7) Claim(s) _____ is/are objected to.
 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ . |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____. | 6) <input type="checkbox"/> Other: _____ . |

POLYELECTROLYTE MEMBRANE AND PRODUCTION METHOD
THEREOF

Examiner: Z. Best S.N. 10/518,026 Art Unit: 1795 October 21, 2008

DETAILED ACTION

1. Applicant's amendment filed on August 7, 2008 was received. Claims 1, 17, 19, and 21 were amended. Claims 7-8 and 11 were cancelled. Claims 23-25 were newly added.
2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Specification

3. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Rejections - 35 USC § 103

4. The rejections under 35 U.S.C. 103(a) of Claims 1-4, 6, 11, 14-17, and 19 as being unpatentable over Nakagawa et al. in view of Funaoka et al. are withdrawn because Claims 1, 17, and 19 were amended.

5. The rejections under 35 U.S.C. 103(a) of Claims 5 and 21 as being unpatentable over Nakagawa et al. in view of Funaoka et al. and further in view of Kim et al. are withdrawn because Claims 1, 17,19, and 21 were amended.

6. The rejections under 35 U.S.C. 103(a) of Claims 7-9 and 12-13 as being unpatentable over Nakagawa et al. in view of Funaoka et al. and further in view of Narang et al. are withdrawn because Claims 1, 17, and 19 were amended.

7. The rejection under 35 U.S.C. 103(a) of Claim 10 as being unpatentable over Nakagawa et al. in view of Funaoka et al. and Narang et al. and further in view of Kaneko et al. is withdrawn because Claims 1, 17, and 19 were amended.

8. The rejections under 35 U.S.C. 103(a) of Claims 18 and 20 as being unpatentable over Nakagawa et al. in view of Funaoka et al. and further in view of Ichino et al. are withdrawn because Claims 1, 17, and 19 were amended.

9. The rejection under 35 U.S.C. 103(a) of Claim 22 as being unpatentable over Nakagawa et al. in view of Funaoka et al. and Kim et al. and further in view of Ichino et al. is withdrawn because Claim 21 was amended.

10. Claims 1-4, 6, 9, 14-17, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al. (WO01/86748) in view of Funaoka et al. (WO00/20493) and Paronen (US 6,630,518 B1). Subsequent reference to Nakagawa et al. and Funaoka et al. are based on corresponding U.S. Patent Nos. 7,029,793 B2 and 6,666,969 B1.

Regarding Claims 1, 9 and 23, Nakagawa et al. teach a polymer electrolyte membrane comprising a microporous membrane (col. 9, lines 29-30), wherein the microporous polymer membrane contains a mixture of a polymer, such as polyethylene (col. 9, lines 28-30), and a molten salt at a weight ratio of 1/9 (col. 18, lines 3-14) and/or a molten salt (col. 10, lines 6-15), that is molten at room temperature (approximately 25° C, col. 10, lines 6-15). However, Nakagawa et al. fail to teach said microporous membrane has pores penetrating through the opposite sides thereof, or that the membrane comprises a heat-resistant aromatic polymer.

Funaoka et al. teach a microporous membrane (abstract) that comprises through-holes in the membrane (col. 5, lines 8-11) thereby having an overall porosity (percentage of void) of 45-80% (col. 5, lines 21-25). It is advantageous to use the through-holes of Funaoka et al. because it retains high permeability (col. 5, lines 12-15). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to create the polymer electrolyte membrane of Nakagawa et al. wherein the polymer membrane has pores penetrating through the opposite sides thereof because Funaoka et al. teach that said through-holes will retain high permeability of the polymer electrolyte membrane.

Paronen teaches a polymer membrane (col. 1, lines 20-30) wherein the membrane may either be a non-aromatic material, such as polyethylene (col. 4, lines 15-25), or an aromatic material, such as an aromatic polyimide (col. 4, lines 26-38), wherein the material is heat resistant (col. 8, lines 18-30). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to create the polymer electrolyte membrane of Nakagawa et al. and Funaoka et al. wherein the polyethylene membrane is substituted by an aromatic polyimide membrane because Paronen teaches the functional equivalency of polyethylene and aromatic polyimide for use as a membrane. While Paronen does not specifically teach that the polymer has a glass transition temperature not below 100 °C, the glass transition temperature property is inherent given both Paronen and the present application utilize the same polymeric separator. A reference that is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. *In Re Roberston* 49 USPQ2d 1949 (1999).

Regarding Claim 2, Nakagawa et al. teach the microporous polymer membrane contains the molten salt (col. 10, lines 6-15).

Regarding Claim 3, Nakagawa et al. teach the microporous polymer membrane holds the mixture of the polymer and the molten salt in the pores thereof (col. 18, lines 3-28).

Regarding Claim 4, Nakagawa et al. teach the microporous polymer membrane holds the mixture of the polymer and the molten salt in the pores thereof and on both sides thereof (col. 18, lines 3-28).

Regarding Claim 6, Funaoka et al. teach the microporous polymer membrane has an average pore size of 0.03-2 μm (col. 5, lines 16-20).

Regarding Claim 14, Nakagawa et al. teach the molten salt has an ammonium ion as a cation component (col. 6, lines 13-17).

Regarding Claim 15, Nakagawa et al. teach the content of the mixture of the polymer and the molten salt is 1/9 by weight (col. 18, lines 3-14).

Regarding Claim 16, Nakagawa et al. teach the content of the molten salt is 10% by volume (col. 10, lines 6-11, LiBF₄ has a volume of 0.11 L/mole).

Regarding Claims 17,19 and 24-25, Nakagawa et al. teach a process of producing a polymer electrolyte membrane containing a molten salt comprising by infiltrating the molten salt into pores of a microporous polymer membrane comprising immersing the microporous polymer membrane having pores in the molten salt (col. 10, lines 1-15), and a molten salt at a weight ratio of 1/9 (col. 18, lines 3-14) and/or a molten salt (col. 10, lines 6-15), that is molten at room temperature (approximately 25° C, col. 10, lines 6-15). However, Nakagawa et al. fail to teach said microporous polymer membrane has pores penetrating through the opposite sides thereof or that the microporous polymer membrane comprises a heat-resistant aromatic polymer.

Funaoka et al. teach a microporous membrane (abstract) that comprises through-holes in the membrane (col. 5, lines 8-11) thereby having an overall porosity (percentage of void) of 45-80% (col. 5, lines 21-25). It is advantageous to use the through-holes of Funaoka et al. because it retains high permeability (col. 5, lines 12-15). Therefore, it would

have been obvious to one having ordinary skill in the art at the time the invention was made to create the process of producing a polymer electrolyte membrane of Nakagawa et al. wherein the polymer membrane has pores penetrating through the opposite sides thereof because Funaoka et al. teach that said through-holes will retain high permeability of the polymer electrolyte membrane.

Paronen teaches a polymer membrane for use in fuel cells (col. 1, lines 20-30) wherein the membrane may either be a non-aromatic material, such as polyethylene (col. 4, lines 15-25), or an aromatic material, such as an aromatic polyimide (col. 4, lines 26-38), wherein the material is heat resistant (col. 8, lines 18-30). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to create the polymer electrolyte membrane of Nakagawa et al. and Funaoka et al. wherein the polyethylene membrane is substituted by an aromatic polyimide membrane because Paronen teaches the functional equivalency of polyethylene and aromatic polyimide for use as a membrane in a fuel cell. While Paronen does not specifically teach that the polymer has a glass transition temperature not below 100 °C, the glass transition temperature property is inherent given both Paronen and the present application utilize the same polymeric separator. A reference that is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. *In Re Roberston* 49 USPQ2d 1949 (1999).

11. Claims 5 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al. in view of Funaoka et al. and Paronen as applied to Claim 1-4, 6, 9, 14-17, and 19 above, and further in view of Kim et al. (Solid State Ionics 144 (2001) 329-337).

Regarding Claim 5, Nakagawa et al., Funaoka et al., and Paronen teach a polymer electrolyte membrane as recited in Paragraph 10. However, Nakagawa et al., Funaoka et al., and Paronen fail to teach said microporous polymer membrane comprises contains the molten salt in the pores thereof and has a layer comprising the mixture of the polymer and the molten salt provided on both sides thereof.

Kim et al. teach a polymer electrolyte for a microporous membrane (abstract), wherein the membrane is coated on both sides with a polymer and soaked in an electrolyte solution to fill the pores (pg. 330). It is advantageous to coat the sides of the membrane because it will encapsulate the electrolyte solution in the porous membrane and further assist in adhering the electrodes to the separator (pg. 330). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to create the polymer electrolyte membrane of Nakagawa et al., Funaoka et al., and Paronen wherein the membrane is coated on both sides with a polymer and soaked in an electrolyte solution to fill the pores because Kim et al. teach that encoating the sides with a polymer will encapsulate the electrolyte solution in the porous membrane and further assist in adhering the electrodes to the separator.

Regarding Claim 21, Nakagawa et al. teach a process of producing a polymer electrolyte membrane containing a molten salt comprising by infiltrating the molten salt into

pores of a microporous polymer membrane comprising immersing the microporous polymer membrane having pores in the molten salt (col. 10, lines 1-15) or impregnating the microporous polymer membrane having pores in a solution of the mixture of a polymer and a molten salt at a weight ratio of 1/9 and irradiating (drying) the membrane with an electron beam (col. 18, lines 3-14), and a molten salt at a weight ratio of 1/9 (col. 18, lines 3-14) and/or a molten salt (col. 10, lines 6-15), that is molten at room temperature (approximately 25° C, col. 10, lines 6-15). A solvent may be used in the solution (col. 4, lines 36-64), and the solvent would dry when the electrolyte became in solid-state (col. 18, lines 13-14).

Nakagawa et al. further suggest impregnation by dipping (immersing, col. 10, lines 12-15). However, Nakagawa et al. fail to teach said microporous polymer membrane has pores penetrating through the opposite sides thereof or that said solution of a mixture of a polymer and a molten salt is applied to both sides of the microporous polymer membrane.

Funaoka et al. teach a microporous membrane (abstract) that comprises through-holes in the membrane (col. 5, lines 8-11) thereby having an overall porosity (percentage of void) of 45-80% (col. 5, lines 21-25). It is advantageous to use the through-holes of Funaoka et al. because it retains high permeability (col. 5, lines 12-15). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to create the process of producing a polymer electrolyte membrane of Nakagawa et al. wherein the polymer membrane has pores penetrating through the opposite sides thereof because Funaoka et al. teach that said through-holes will retain high permeability of the polymer electrolyte membrane.

Paronen teaches a polymer membrane for use in fuel cells (col. 1, lines 20-30) wherein the membrane may either be a non-aromatic material, such as polyethylene (col. 4, lines 15-25), or an aromatic material, such as an aromatic polyimide (col. 4, lines 26-38), wherein the material is heat resistant (col. 8, lines 18-30). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to create the polymer electrolyte membrane of Nakagawa et al. and Funaoka et al. wherein the polyethylene membrane is substituted by an aromatic polyimide membrane because Paronen teaches the functional equivalency of polyethylene and aromatic polyimide for use as a membrane in a fuel cell. While Paronen does not specifically teach that the polymer has a glass transition temperature not below 100 °C, the glass transition temperature property is inherent given both Paronen and the present application utilize the same polymeric separator. A reference that is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. *In Re Roberston* 49 USPQ2d 1949 (1999).

Kim et al. teach a polymer electrolyte for a microporous membrane (abstract), wherein the membrane is coated on both sides with a polymer and soaked in an electrolyte solution to fill the pores (pg. 330). It is advantageous to coat the sides of the membrane because it will encapsulate the electrolyte solution in the porous membrane and further assist in adhering the electrodes to the separator (pg. 330). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to create the process of producing the polymer electrolyte membrane of Nakagawa et al., Funaoka et al.,

and Paronen wherein the membrane is coated on both sides with a polymer and soaked in an electrolyte solution to fill the pores because Kim et al. teach that encoating the sides with a polymer will encapsulate the electrolyte solution in the porous membrane and further assist in adhering the electrodes to the separator.

12. Claims 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al. in view of Funaoka et al. and Paronen, as applied to Claims 1-4, 6, 9, 14-17, and 19, and further in view of Kaneko et al. (U.S. Patent No. 5,494,991 A).

Nakagawa et al., Funaoka et al., and Paronen, teach the polymer electrolyte membrane as recited in Paragraph 10. However, Nakagawa et al., Funaoka et al., and Paronen fail to teach said polyimide constituting the microporous polyimide membrane comprises at least 1 mol% of 3,3'-dihydroxy-4,4'-diaminobiphenyl based on the total diamine component.

Kaneko et al. teach a polyimide polymer comprising up to 10% of 3,3'-dihydroxy-4,4'-diaminobiphenyl based on the total diamine component (col. 9, lines 8-45). It is advantageous to add 3,3'-dihydroxy-4,4'-diaminobiphenyl to the polyimide polymer because it will improve thermal dimensional stability and mechanical strength (col. 2, lines 1-11). Therefore, it would have been advantageous to one having ordinary skill in the art at the time the invention was made to create the microporous polyimide membrane of Nakagawa et al., Funaoka et al., and Paronen with up to 10% of 3,3'-dihydroxy-4,4'-diaminobiphenyl

based on the total diamine component because Kaneko et al. teach the additional polymeric component improves thermal dimensional stability and mechanical strength.

13. Claims 12-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al. in view of Funaoka et al. and Paronen as applied to Claim 1-4, 6, 9, 14-17, and 19 above, and further in view of Suzuki et al. (US 6,815,124 B2).

Regarding Claims 12-13, Nakagawa et al., Funaoka et al., and Paronen teach a polymer electrolyte membrane as recited in Paragraph 10. However, Nakagawa et al., Funaoka et al., and Paronen fail to teach said polymer of the mixture is a cation exchange group-containing member.

Suzuki et al. teach a gel electrolyte employed as a matrix polymer mixture with a salt (abstract), wherein the matrix polymer comprises a carboxyl group, which is added in order to improve the ionic conductivity of the electrolyte at low temperature (abstract). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to create the microporous polyimide membrane of Nakagawa et al., Funaoka et al., and Paronen wherein the polymer of the mixture comprises a carboxyl group because Suzuki et al. teach the addition of the carboxyl group to the polymer of the electrolyte will improve the ionic conductivity of the electrolyte at low temperature. Furthermore, while Suzuki et al. does not specifically teach the cation exchange group polymer electrolyte has an ion exchange capacity of 0.3-7 meq/q, the ion exchange capacity is inherent given that both Suzuki et al. and the present application utilize the same polymeric separator. A reference

that is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. *In Re Roberston* 49 USPQ2d 1949 (1999).

14. Claims 18 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al. in view of Funaoka et al. and Paronen as applied to Claim 1-4, 6, 9, 14-17, and 19 above, and further in view of Ichino et al. (U.S. Patent No. 5,858,264 A).

Regarding Claims 18 and 20, Nakagawa et al., Funaoka et al., and Paronen teach the methods of producing a polymer electrolyte membrane as recited in Paragraph 2 above. However, Nakagawa et al., Funaoka et al., and Paronen fail to teach infiltration of the pores by either the molten salt or the mixture by vacuum degassing and/or pressurizing.

Ichino et al. teach a process for producing a polymer electrolyte membrane wherein the membrane is impregnated with the polymer via a vacuum treatment (col. 4, line 66 - col. 5, line 22). It is advantageous to impregnate the membrane with a vacuum treatment because it will remove the air from the pores (col. 5, lines 8-11). Therefore, it would have been obvious to one having ordinary skill in the art to use the process of producing a polymer electrolyte membrane of Nakagawa et al., Funaoka et al., and Paronen wherein a vacuum treatment is used to impregnate the polymer into the polymer electrolyte membrane because Ichino et al. teach the vacuum treatment impregnation will remove air from the pores of the membrane.

15. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al. in view of Funaoka et al., Paronen, and Kim et al. as applied to Claim 21 above, and further in view of Ichino et al. (U.S. Patent No. 5,858,264 A).

Regarding Claim 22, Nakagawa et al., Funaoka et al., Paronen and Kim et al. teach the method of producing a polymer electrolyte membrane as recited in Paragraph 11 above. However, Nakagawa et al., Funaoka et al., Paronen and Kim et al. fail to teach infiltration of the pores by either the molten salt or the mixture by vacuum degassing and/or pressurizing.

Ichino et al. teach a process for producing a polymer electrolyte membrane wherein the membrane is impregnated with the polymer via a vacuum treatment (col. 4, line 66 - col. 5, line 22). It is advantageous to impregnate the membrane with a vacuum treatment because it will remove the air from the pores (col. 5, lines 8-11). Therefore, it would have been obvious to one having ordinary skill in the art to use the process of producing a polymer electrolyte membrane of Nakagawa et al., Funaoka et al., Paronen and Kim et al. wherein a vacuum treatment is used to impregnate the polymer into the polymer electrolyte membrane because Ichino et al. teach the vacuum treatment impregnation will remove air from the pores of the membrane.

Response to Arguments

16. Applicant's arguments filed on August 7, 2008 have been fully considered.

Applicant argues:

(a) *The aromatic polyimide of Narag et al. corresponds to the polymer in the mixture of a polymer and a molten salt and not the microporous polymer membrane.*

In response to Applicant's arguments:

(a) Examiner is persuaded by Applicant's arguments regarding Narang et al.

However, Paronen uses the aromatic polyimide as a polymer membrane, and teaches the functional equivalency of the polymer membrane materials of Nakagawa et al. with the aromatic materials of Paronen for use as said membrane material.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Zachary Best whose telephone number is (571) 270-3963. The examiner can normally be reached on Monday to Thursday, 7:30 - 5:00 (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dah-Wei Yuan can be reached on (571) 272-1295. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

zpb

/Dah-Wei D. Yuan/
Supervisory Patent Examiner, Art Unit 1795